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ANSWERS TO ASSIGNMENT:

1). A particle moves along a curve, $x = t^2$, $y = -5t^2 + t$, $z = t + 7$, where t is time. Find its acceleration.

Sol

$x = t^2$, $y = -5t^2 + t$, $z = t + 7$.

Given $A(t) = a_x(t)_i + a_y(t)_j + a_z(t)_k$.

Velocity $\left(\frac{dA}{dt}\right) = ?$, Acceleration $\left(\frac{d^2A}{dt^2}\right) = ?$

but $A(t) = t^2_i + (-5t^2 + t)_j + (t - 7)_k$.

Velocity $\left(\frac{dA}{dt}\right) = 2t_i + (-10t + 1)_j + (1 - 7)_k$.

Velocity $\left(\frac{dA}{dt}\right) = 2t_i + (-10t + 1)_j - 6_k$

Acceleration $\left(\frac{d^2A}{dt}\right) = 2_i + (-10)_j = 2i - 10j$

2). If $P = i - 9j - 4k$, $Q = 8i - 3j + 6k$, $R = i - 4j - 3k$, Find $(P \times Q) \cdot (R \times P)$.

Solution

Given $P = i - 9j - 4k$, $Q = 8i - 3j + 6k$, $R = i - 4j - 3k$.

$$P \times Q = \begin{vmatrix} i & -j & +k \\ 1 & -9 & -4 \\ 8 & -3 & 6 \end{vmatrix}$$

$$= i \begin{vmatrix} -9 & -4 \\ -3 & 6 \end{vmatrix} - j \begin{vmatrix} 1 & -4 \\ 8 & 6 \end{vmatrix} + k \begin{vmatrix} 1 & -9 \\ 8 & -3 \end{vmatrix}$$

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$= i((-9\times6)-(-3\times-4)) - j((1\times6)-(8\times-4)) + k(-3+72)$

$= i(-54-12) - j(6+32) + k(69)$.

$(P\times Q) = -66i - 38j + 69k$

$(R\times P) = \begin{vmatrix} + & - & + \\ i & j & k \\ 1 & -4 & -3 \\ 1 & -9 & -4 \end{vmatrix}$

$(R\times P) = i\begin{vmatrix} -4 & -3 \\ -9 & -4 \end{vmatrix} - j\begin{vmatrix} 1 & -3 \\ 1 & -4 \end{vmatrix} + k\begin{vmatrix} 1 & -4 \\ 1 & -9 \end{vmatrix}$.

$= i(16-27) - j(-4+3) + k(-9+4)$.

$= -11i + j - 5k$

$\therefore (P\times Q).(R\times P) = (-66i - 38j + 69k).(-11i + j - 5k)$

= Using dot product

$= 726i - 38j - 345k$.

3) Given $F = 5\cos 7t\,i - 2e^{3t}\,j - 4t^3\,k$, find the integral of F with respect to t.

Solut.

$F = 5\cos 7t\,i - 2e^{3t}\,j - 4t^3\,k$.

Integral of $F = \int 5\cos 7t\,i - 2e^{3t}\,j - 4t^3\,k$

$= 5\left(\frac{1}{7}\sin 7t\right)i - 2\left(\frac{1}{3}e^{3t}\right)j - \frac{4t^{3+1}}{3+1}k$

$= 5\left(\frac{1}{7}\sin 7t\right)i - 2\left(\frac{1}{3}e^{3t}\right)j - \frac{4t^4}{4}k + C$.

$= 5\left(\frac{1}{7}\sin 7t\right)i - 2\left(\frac{1}{3}e^{3t}\right)j - t^4k + C$.